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TEACHER'S GUIDE:

COMPANION TO

Bartholomew's Drawing-Book No. 3.

FOR TEACHERS AND STUDENTS USING BARTHOLOMEW'S DRAWING-BOOKS.

BY

W. N. BARTHOLOMEW,

PROFESSOR OF DRAWING IN THE ENGLISH HIGH AND BOSTON NORMAL SCHOOLS.

NEW YORK:
WOOLWORTH, AINSWORTH AND COMPANY.
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Entered, according to Act of Congress, in the year 1869, by
W. N. BARTHOLOMEW,
In the Clerk's Office of the District Court of the District of Massachusetts.

Geo. C. Rand & Avery,
Stereotypers and Printers,
3 Cornhill, Boston.

INTRODUCTORY CHAPTER.

In the previous lessons of this series, the attention of the pupil has been wholly confined to the drawing of lines, angles, and plane figures, as they appear when fronting the observer: he is now about to attempt their representation as they appear when viewed obliquely. When a line is seen obliquely, its apparent measure is less than its actual measure, and its apparent direction varies more or less from its actual direction; and, since all forms are bounded by lines, it follows that any apparent change in their length and direction must produce an apparent change in the form of the surface which they enclose.

It might be supposed by those who have no practical knowledge of drawing, that any one who has a disciplined eye and a trained hand, would have no difficulty in detecting and expressing the apparent form of any surface, however seen; but this is not the case. Something more than a disciplined eye and a trained hand is required for this. One must have some knowledge of the laws of perspective. When this subject is understood, all that is needed is a distinct apprehension of the actual form and position of an object, in order to determine what its apparent form must be; and, knowing this, one knows what to look for; and, knowing what to look for, he soon learns to recognize the apparent form of an object as readily as he does its actual form.

Possibly some one may be inclined to say, "All this may be true; but is it necessary to understand the laws of perspective, and be able to determine the form which any given object must present to the eye, in order to draw the examples connected with these lessons?" My answer is, "No, if the examples are to be drawn *mechanically*; yes, if they are drawn *understandingly*." If the pupils are to be taught the art of *copying* simply, it is not absolutely necessary that they should be acquainted with the laws of perspective; but, if they are to learn the art of *drawing*, these laws must be understood.

It is because pupils are allowed to spend their time in thoughtless imitation, making line for line, and dot for dot, because it is so in the copy, that so few are ever able to do any thing when they attempt to draw from Nature. Ask a class, where this system of teaching is adopted, to draw the simplest object, and you ask an impossibility. No one ever did, or ever will, learn the art of drawing, in this way. How unreasonable it would be to think of gaining a knowledge of arithmetic by simply copying the problems which another had worked out! In teaching arithmetic, the attention of the pupil is first directed to the study of principles; he is then shown, by illustration, how these principles are applied in the solution of problems; and then problems are given him to work out, in order to make him familiar with the application of the principles involved. Now, a course similar to this is the one we should pursue in teaching the art of drawing. Before the pupil is allowed to draw the first example in these lessons, he should be made acquainted with the principles involved in its construction. In every instance, before he touches his pencil to paper, he should be required to give a satisfactory reason for all he is about to do. "Because it is so in the copy," should never be taken for an answer: it is no reason at all. Suppose the example to be incorrectly drawn, what then? If there is an error in the copy, he should know enough to enable him to detect the error, and correct it in his drawing. When one is able to do this, he needs only a little practice to prepare him to draw from the object itself just as readily and as correctly as from a copy; and this is the end at which all our instruction should aim. Any system of teaching which does not have this for its object, or which fails to secure it, is not worthy of attention.

In teaching perspective to a class of children, it is useless to adopt the course taken in any of the scientific text-books on this subject. Treated in this way, it is above the comprehension of children. Neither should we adopt the plan which simply requires the pupil to commit to memory the rules of perspective, the truth of which they are expected to take on faith. If we adopt the former, we attempt too much; and the result is, the pupils are puzzled and perplexed, and the study is made irksome and distasteful. If we adopt the latter, we attempt too little; the pupils work mechanically, have no certain knowledge of what they are about, and hence feel little interest in what they are doing.

The fact that the intellect of a child is not sufficiently developed to enable him to understand a mathematical demonstration of the laws of perspective, is no reason why we should neglect to present some kind of proof of their truth. The perceptive faculties of the child are developed in advance of the reflective powers; and he may be made to comprehend truths which are not at first apparent, by some simple proof addressed to the eye, long before he can understand any scientific demonstration of them. This should suggest to us the course we should take in presenting this subject to children.

As a hint to the inexperienced teacher, I shall present this subject, as nearly as circumstances will admit, as I would if I stood before a class of children. It will be understood, of course, that I can give but a general outline of what may be required in order to impress the truths presented, on the minds of those supposed to be addressed. I should proceed somewhat as follows. Addressing the class, —

Thus far your attention has been confined to the drawing of lines and plane figures. Plane figures, as you know, have only two dimensions; viz., length and breadth. It is easy to see how a form having only length and breadth can be accurately represented on a plane surface, as a sheet of paper; but perhaps you cannot so readily understand how an object having length, breadth, and thickness can be correctly represented on such a surface. This I propose to explain to you, in order that you may draw the examples given in your drawing-books understandingly, and that you may draw from objects correctly.

When we look at an object, — as a house, for example, — we do not see its *actual form*, and, in drawing it, we do not make its actual form, but the form which it *appears* to have; that is, the form which it presents to the eye. That you may clearly understand what is meant by this, let me illustrate my meaning. Suppose you were to stand before a window out of which you could see a building. Now, if you had something with which you could mark on glass, you could, by keeping the eye steady, trace each line, in the outline of the building on the glass, just as it appears to you. If you were careful to trace the lines accurately, it is evident that the drawing would give the *apparent form* of the building.

If you were to examine a drawing made in this way, you would find that the outline of the drawing differed very materially from the actual outline of the building. Many of the lines which are of equal length in the building would be of unequal length in the drawing; and many lines that are horizontal in the building would be inclined in the drawing, some inclining upward, and others downward.

On looking at an object, we have always been in the habit of recognizing its *actual form*. When you look at a book, for example, as it lies on the desk before you, the mind receives the impression, from what the eye sees, that its opposite sides are parallel, and that the angles are all right angles; but this is not the form which the book appears to have, as we shall presently see. So accustomed are we to this way of looking at things, that one must make the matter a study before he can detect the exact form which an object presents to the eye.

The form which an object presents to the eye is always the same when viewed from a given point. If a stone is tossed into the air, it falls to the ground by the operation of the laws of gravitation: you never doubt the result. Now, there are certain laws which govern the apparent forms of objects, which are just as certain in their operations as are the laws of gravitation. Let us see if we cannot discover some of these laws.

Let each member of the class take his arithmetic, and set it up on end, near the back of his desk, directly in front of him, and with one of its covers facing him.* Observe how I have placed my book.

When a surface faces you, it is said to present a *front view*. The cover of your book presents a *front view* to you; so do the lines that bound it; and so would any line that might be drawn on it.

There is one fact I want you to notice in regard to this cover. You will observe that all parts of it are equally far in the distance. Now I want you to understand, and remember, that, when this is true of any surface or line, the surface or line presents a front view.

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* It is immaterial, of course, what book is used. What is desired is, that the books should be of good size, and all of the same size and form.

Question. — Who can tell me when a line or surface presents a *front view?*

Let us now consider how surfaces and lines appear when they present a front view.

Question. — Do you think the cover of the book appears just as long and just as wide as it really is?

Answer. — Yes.

Question. — Do you think the angles formed by the sides of the cover appear to be right angles?

Answer. — Yes.

Then the apparent form of the cover must be the same as its actual form. Before we consider this matter as settled, let us test this question. Taking hold of your pencil by one end, hold it vertically between your eye and the upright sides of the book. Compare the position of these sides of the cover with that of the pencil, and see if they appear to be parallel to it, testing first one side and then the other.

Question. — Do these sides appear to be parallel to the pencil?

Answer. — Yes.

Now, holding the pencil horizontal, and facing you, compare the position of the upper and lower sides of the cover with that of the pencil, and see if they appear to be parallel to it.

Question. — Do they appear parallel to the pencil?

Answer. — Yes.

I will draw a figure on the board, of the form of the cover, making the upright sides vertical, and the upper and lower sides horizontal.

Question.—Does this drawing look as the cover appeared to you?

Answer.—Yes.

We may lay it down as a rule then, that,—

Surfaces presenting a front view appear of their actual form.

And that,—

Lines presenting a front view appear in their actual position.

Point out any surface which presents a front view to you.

Point out any lines which present a front view to you.

Question.—Do all vertical lines present a front view?

Answer.—Yes. This must be the case, for every part of a vertical line is equally far in the distance.

Let us take another view of this book. Before doing so, however, you may take out your grammar, or some book about that size. Lay your arithmetic on your desk, directly in front of you, with the back of the book towards you. Now set the other book upright on the desk, letting it rest on one end, with one of its covers touching the back of the arithmetic, and so place it that you can see about as much of the back of the arithmetic on one side of the book as you can on the other.

Observe how I have placed my books. If you have your books placed as directed, you can see both extremities of the line forming the farther side of the cover of the book lying on the desk.

I want you to compare the apparent length of the line forming the farther side of the cover of the arithmetic with the apparent length of the line forming the nearer side, and see if they appear to be of the same length.

Close one eye, and keep the head still, while doing what I am about to direct you to do. Without disturbing the book which lies on the desk, gradually move the other to the left, and stop just as the book is about to hide from view the last point in the farther side of the cover.

Question. — When you have done as directed you may tell me if the book must be moved still farther to the left before it would hide from view the corresponding point in the nearer side of the cover.

Answer. — Yes: the book must be moved some distance to the left before it would hide this point from view.

Keeping this fact in mind, let us see how it is with the other extremities of these lines; but, before doing this, let us be certain that you have not moved your head. See that your eye is in a line with the edge of the upright book and the point beyond, and then, without moving the head, move the book to the right until nothing of the farther side of the cover is seen but the extreme point on the right.

Question. — When this has been done, tell me if the book must be moved still to the right before it would shut out your view of the corresponding point in the nearer side of the cover.

Answer. — Yes: it would be necessary to move the book still farther to the right before it would hide that point from view.

Question. — Now, since the farther side of the cover does not appear to extend so far to the right, nor so far to the left, as the nearer side, what follows from this?

Answer. — It follows, that the farther side appears to be shorter than the nearer side.

Question. — Do these lines present a front view?

Answer. — Yes.

Question. — What is their actual length compared with each other?

Answer. — They are equal.

From these facts, we derive the following rule: —

Lines of equal length, presenting a front view, when seen at unequal distances, appear unequal, the most distant appearing the shortest line.

We have already decided that lines parallel to each other appear parallel when they present a front view. When the book was so placed that one of its covers presented a front view, the upright sides appeared to be parallel to each other; and the same was true of the upper and lower sides. Let us now see whether lines, parallel to each other, appear to be parallel when they are seen *obliquely*, that is, when they recede from the observer, one end of the lines being farther in the distance than the other. For this purpose, take two books of the same length and width, and place them on the desk before you, as I place these books before me. You will observe that I have placed the books horizontally on the desk, with the ends together, so that the backs of the books form one straight line; and this line faces me, and its centre is directly before me. The three lines formed by the receding sides of the covers are parallel to each other, and the question to be decided, is, do they appear to be parallel? and, if they do not, how do they appear?

When we had a front view of the book, we decided that its opposite sides appeared to be of equal length. These lines presented a front view, and were seen at the same distance. In the lines forming the farther sides of the covers of these books, we have a similar case. These lines are equal, they present a front view, are equally far in the distance, and therefore they must appear equal. For the same reason, the sides nearer you must appear equal; but, being nearer, they must appear longer than the more distant sides.

Question.—This being the case, how must the receding sides of the covers appear?

Answer.—They must appear to approach each other as they recede.

Yes: they appear to approach each other as they recede; and, if sufficiently produced, they would meet at the same point. If this fact is not already obvious to you, it will be apparent when you see it illustrated on the board.

Let me draw a horizontal line to represent the line formed by the nearest sides of the covers. Just above this line, I will draw a line parallel to that first drawn, and shorter than that line. Let this line represent the line formed by the farther sides of the covers. We will now divide each of these lines into two equal parts, and draw lines connecting corresponding points to represent the receding sides of the covers. These lines approach each other, as you said they would; and now let us see if, on being prolonged, they will meet at the same point. I have now produced the lines; and they meet at the same point, as you see. From this it is evident that —

Parallel lines, receding from the observer, appear to approach each other as they recede; and, if sufficiently prolonged, they would appear to meet at the same point.

These facts are quite obvious to one who has an extended view of a railroad where there is a double track. The rails plainly appear to approach each other as they recede, and seem to meet at a point in the extreme distance.

Question. — Have any of you ever observed these facts as you looked along the track on a railroad?

The view of a railroad also affords a fine illustration of the fact already noticed, that lines presenting a front view appear to diminish in length in proportion to their distance from the observer. On looking along the track, the timbers on which the rails rest appear shorter and shorter, the farther they are from the observer.

Question. — How many have noticed this fact?

We have already decided that horizontal lines appear horizontal when they present a front view. Let us now see if they appear horizontal when seen obliquely.

To assist us in deciding this question, we shall need two books. If there is a difference in their size, take the larger one and lay it down on the horizontal part of the desk; let the book be directly in front of you, and let the longest sides of the covers recede directly from you. See how I have placed my book. The receding sides of the covers are horizontal; they are below the eye, and they are seen obliquely. We are to decide whether they appear horizontal; and, if they do not thus appear, we are to determine how they do appear. For this purpose, hold the other book directly before you, with the cover facing you; let the lower side of the book be exactly horizontal, and support the book by taking hold of the ends, thus. Now, being careful to keep the lower side of the book horizontal, and the cover facing you, hold it so that on looking under the cover you can see nothing of the lines forming the receding sides of the upper cover of the book on the desk, except the ends nearest you. Then raise the book which you hold in your hands, and you will see more and more of these lines as you raise the book; and, when you have carried it sufficiently high to admit of your seeing the farther extremity of the lines, it will have been raised several inches, perhaps, above where it was when you could see only the nearer extremities.

Question.— What does this show in regard to the apparent position of the lines?

Answer.— It shows that the farther extremities of the lines appear to be higher than the nearer extremities, or, in other words, that the lines appear to incline upwards as they recede.

Let us now see how horizontal lines, receding from the observer, appear when above the eye. Take the book which lies on the desk in the left hand, taking hold of the back; hold it so that the side opposite the back shall be uppermost, horizontal, some distance above the eye, with the end towards you, and so that the covers shall recede directly from you. Observe how I hold my book. We wish to see if the upper sides of the cover appear horizontal. Taking the other book by the back, in the right hand, hold it before you, with the cover facing you, with the back downward and horizontal. In this way. Then raise this book until you can see nothing of the line we are to consider, except the nearer extremity. When this has been done, gradually lower the book which you hold in your right hand. As the book is dropped, you see more and more of the line; and, when you have lowered it so as to bring into view the farther extremity of the line, you will have dropped it some little distance.

Question. — What does this show in regard to the appearance of this line?

Answer. — It shows that it appears to incline downward as it recedes.

Question. — Since horizontal lines, receding from the observer, when below the eye appear to incline upward as they recede, and when above it appear to incline downward as they recede, how must they appear when they are neither above nor below it?

Answer. — They would appear horizontal.

The facts we have now learned in regard to the apparent position of horizontal lines when seen obliquely may be stated thus —

Horizontal lines receding from the observer, if above the eye, appear to incline downward as they recede; if below the eye, they appear to incline upward as they recede; and if on a level with the eye, they appear horizontal.

Having decided the question in regard to the apparent position of horizontal lines when seen obliquely, let me suggest another, and with that we will close the lesson.

When a surface is seen obliquely, is its apparent measure the same as when it presents a front view, its distance from the observer being the same in both cases? To determine this question, take a book whose covers are perfect planes, or nearly so, and hold it so that its longest sides shall be upright, supporting it with the left hand by taking hold of the lower left hand corner of the book; let one of the covers face you, and let its centre be about on a level with the eye. Notice how I hold my book. Now take your pencil in your right hand, taking hold of it near the pointed end, and place the side of the pencil against the cover horizontally; let the blunt end of the pencil touch the left side of the cover; place the end of the thumb or forefinger of the right hand on the pencil, at the point where it crosses the line forming the right side of the cover. The distance between the end of the thumb or finger, and the blunt end of the pencil, measures the apparent width of the cover. Now, being careful to keep the end of the pencil against the left side of the cover, and your thumb on the pencil where you now have it, and being careful not to move the pencil in any way, turn the book so as to bring its right side away from the pencil, so that the cover will make with the pencil an angle of about forty-five degrees; that is, about one half a right angle.

Question.— Before you turned the book, the apparent width of the cover was measured by the distance between the end of your pencil and your thumb. Is this the case now?

Answer. — No. The right side appears to be on the right of the left side, only about one-half the distance between the end of my pencil and thumb.

Question. — This being the case, how wide does the cover appear compared with its apparent width when it presented a front view.

Answer. — About one half as wide.

Continue to turn the book, very gradually, until the right side of the cover comes directly behind the nearer side. As you turn the book, the cover is seen more and more obliquely; and you will notice, that, the more obliquely it is seen, the less is its apparent width. This apparent diminution in the width of the cover is called *fore-shortening.* A line or surface is said to be *fore-shortened* when its measure is apparently diminished, owing to its being seen obliquely. From this investigation we learn that —

Surfaces seen obliquely are fore-shortened; and, the more obliquely they are seen, the more they are fore-shortened.

We have now noticed all of those general truths that are of special service in drawing from objects or from copies. The next thing is for you to make yourselves perfectly familiar with these truths, and with their application. This may be done by carefully studying the examples given in your drawing-book, and by making thoughtful drawings of them.

As it will be more convenient, in referring to the rules, to have them together, we insert them here. These rules should be committed to memory before drawing is attempted. The pupils should be able to recite, without hesitation, any rule on being told the number of the one required.

RULE 1. — *Surfaces presenting a front view appear of their actual form.*

RULE 2. — *Lines presenting a front view appear in their actual position.*

RULE 3. — *Lines of equal length, presenting a front view, when seen at unequal distances, appear unequal, the most distant appearing the shortest line.*

RULE 4. — *Parallel lines, receding from the observer, appear to approach each other as they recede; and, if sufficiently prolonged, they would appear to meet at the same point.*

Rule 5. — *Horizontal lines, receding from the observer, if above the eye, appear to incline downward as they recede; if below the eye, they appear to incline upward as they recede; and if on a level with the eye, they appear horizontal.*

Rule 6. — *Surfaces seen obliquely are fore-shortened; and, the more obliquely they are seen, the more they are fore-shortened.*

GENERAL REMARKS ON OUTLINE-DRAWING.

In drawing an object, we first make an outline, defining the form of the several parts. When shade is to be added to the outline, the lines which define the parts to be shaded should always be made as light as is consistent with distinctness, so that they will not be visible when the shade is added. In nature, which we aim to represent as truthfully as our means will allow, there are no dark lines bordering surfaces. The contour of a surface is never darker than the parts lying in close proximity to it. As an illustration of what we mean, see Ex. 1, Lesson 2. It will be observed that the lines, bounding the faces in shade, are neither darker nor lighter than the shade on the faces which they bound. In this respect, the drawings are like nature. There are cases, however, where it is necessary to represent the contour of a surface by a visible outline; as, for example, in representing the face A B C D, of this cube, it was necessary to make the lines A B and A D dark, as this was the only way of defining the form of the face on these sides, unless we threw that part of the face in shade, or put a tint on the paper to form a back-ground, leaving the face light.

Let it be understood, then, that, in drawing the outlines of objects, the lines defining the parts to be shaded must, in all cases, be made *very light.*

LIGHT, SHADE, AND SHADOW.

Those parts of objects on which the direct rays of light fall are said to be in *light*, and those parts turned from the source of light are said to be in *shade*. *Shadow* is that darkness which overspreads a surface in consequence of an opaque body coming between the surface and the point from which the light proceeds.

After a correct outline has been made, shade and shadow must be added before the picture can have the appearance of nature. Light, shade, and shadow are important aids in conveying an idea of solidity and of space.

Before the pupils are allowed to add shade to their outlines, their attention should be called to the truths expressed in the following rules, and the words should be committed to memory. I would not have this done, however, until the pupils are ready to shade. My practice is, never to allow my pupils to have any thing to do with this branch of the subject until they have had considerable practice in outline-drawing. When they can produce a tolerably correct outline of an object, from their knowledge of the laws of linear perspective, they are then ready to take up the subject of light, shade, and shadow. The old rule, "one thing at a time," works well here.

RULE 1.—*When a receding surface is in shade, the intensity of the shade diminishes as the surface recedes;*

when it is in light, the intensity of the light diminishes as it recedes.

This effect is produced by the color of the atmosphere, or of the vapors which pervade it. The most remote parts of a surface, being seen through a greater body of atmosphere than those nearest the observer, partake more of the color of the atmosphere; and hence lights are weakened, and shadows are reduced, as stated in the rule.

This truth is strikingly illustrated in the case of distant hills and mountains. It is quite likely that many of the pupils have seen a mountain from a great distance; and they may be able to remember that the darkest and the brightest objects on it blended together in one hue, all appearing to be of a light blue or gray color, so faint, perhaps, as to be scarcely visible.

The truth stated in this rule may be further illustrated by causing the pupils to stand before a closed window, and having them compare the intensity of the shade on the sash with some distant object, known to be equally dark. Then let them take some object in light, nearer hand, and compare it with some object in the extreme distance which is actually equally light.

RULE 2.—*The brightest light is never on the outline of the illuminated side of a cylinder, and the deepest shade is never on the outline of the side in shade.*

In illustrating the truth of this rule, select some cylindrical object, let it be *pure white* if possible, and place it in a strong light. Be careful to shut out all cross light, allowing the light to come from one point only. Under the best of circumstances, it is possible, that, from the want of a disciplined eye, the pupils may not be able to see the truth of the facts stated. If so, they must take them on faith until they are able to see for themselves. It is presumed here, that the pupils are not sufficiently advanced to understand a scientific demonstration of the truth of the rule.

RULE 3. — *When an object casting a shadow, and the surface on which it falls, are equally dark, and in close proximity to each other, the shadow is darker than the shaded side of the object casting it. If the surface receiving the shadow is darker than the object casting it, the strength of the shadow is increased.*

In showing the truth of this rule, choose a window on the sunny side of the house so as to get a strong shadow. Place a book with a light cover upright against the window-frame, so that one of its covers shall be in shade. Then place another book, whose covers are equally light, on the window-sill, and against the upright book, so as to receive the shadow of the upright book on one of its covers. The difference between the intensity of the shade and that of the shadow will be so marked, that even the dullest eye will be able to detect it.

When the truth of the first part of the rule has been shown to the satisfaction of all, remove the book receiving the shadow, and in its place put one with a dark cover. The marked difference in the strength of the shadow, no one can fail to see.

RULE 4.— *The strength of a shadow diminishes in intensity as it recedes from the object casting it.*

If a sheet of white paper be placed on the window-sill, so as to receive the shadow cast by a book, or any other object, placed on the paper, the truth of the rule will be apparent at a glance. The reason why a white surface is recommended to receive the shadow is because the difference in the intensity of the several parts of the shade is more noticeable on a white ground than on a darker one. The law, however, applies to dark objects as well as to those which are light.

RULE 5.— *The outline of a shadow is the most clearly defined at the point nearest the object casting the shadow, and it gradually becomes more obscure as it departs from this point.*

No better arrangement can be made for showing the truth of this rule than that used in showing the truth of Rule 4.

RULE 6.— *The outline of a shadow corresponds to the form of the surface on which it falls.*

If a book and paper be placed as suggested in case of Rule 4, it will be observed that the outline of the shadow is perfectly straight; that is, if the paper lies flat upon the window-sill. Gradually curl the paper, in a direction perpendicular to the line of shadow, and observe the changes which take place in its outline.

Having demonstrated to the class the truth of these rules, they will not, if properly directed, blindly imitate the copy. They will depend, rather, upon the knowledge which they have acquired, and be guided in their work by the perfect laws of nature. Should there be a blemish in the shade given to the copy, should it be uneven where it should be even, or should any part be too light or too dark as compared with other parts, they will detect the error, and avoid it in their drawing. And we may here remark, that it is not at all improbable that imperfection may be found in the copies, notwithstanding the fact that the greatest care has been taken to make them correct. In lithography, so much depends upon the printer, that the work, if well executed on the stone, may come good or bad, according to his ability, or to the care which he takes in printing it.

Having made the pupils acquainted with the laws of light, shade, and shadow, the next thing is to teach them how these effects are to be produced.

In making a pencil-drawing on a white ground, the paper is left perfectly white, to represent the strongest light. Shade and shadow are represented by a series of parallel lines placed so near together that they touch each other.

To make an *even* shade, that is, a shade that shall be equally dark in all its parts, the lines forming it must be of equal strength throughout, and all lines must be equally strong.

Beginners, of course, are never able to accomplish this successfully at the start, for it requires a trained hand and a disciplined eye. Even though they exercise the greatest care, some lines will be darker than others; some will not be equally dark throughout their whole extent; here and there the lines will be running on to each other, and then again they will be too far apart; and the result is, the shade is uneven. To remedy this defect, it will be necessary to go carefully over the shade again, strengthening such lines, and parts of lines, as may require it, and filling in any light spaces that may have been left between the lines.

In making a *graduated* shade, it is next to impossible for any one to give to each line just the right degree of strength required to grade the shade perfectly. On this account, it is best not to give to any line its full strength, but rely upon going over the work a second, or a third time even, adding a little here or there, as the case may require. In finishing up the shade, a fine-pointed pencil is necessary, in order to enable the pupil to see the exact point of its contact with the paper.

In case it is found inconvenient to draw the lines, forming a shade, the entire length of the surface to be shaded, the lines should be made of even strength until a point is reached near that where it is desired to have them terminate; and from this point they should be made gradually lighter and lighter, leaving the last point scarcely visible. In prolonging the lines, reverse the order of things, and lap the parts together. In this way, the parts may be so well united as to form lines of uniform strength throughout; whereas, if they are left full at the ends where they are joined, an uneven shade will be the result.

In shading, it is very desirable to have a pencil of just the right degree of hardness. If the pencil is too soft, the shade will look rough and coarse, and the friction caused by the leaves of the book rubbing together will smut the drawing. If the pencil is too hard, a sufficient degree of strength cannot be given to the shade; and the drawing will appear weak, smooth, and glossy. In making any common drawing, like those found in the copy-books, no pencil softer than the "Eagle pencil" marked H, or its equivalent, No. 3, should ever be used, and in most cases the H H pencil, or No. 4, will be found to be quite soft enough. Good shading cannot be done with poor pencils. Those which we have here recommended are capable of doing the best of work. The lettered pencils are superior in quality to those marked with numerals.

Before commencing a shade, the pencil should be tried on a bit of waste drawing-paper, for the purpose of grinding down any sharp angle which the lead may present to the paper. This practice is also desirable in order to learn just how much pressure to give the pencil to produce a line of the required strength. After a pencil has been newly sharpened, a few strokes should always be made with it on the waste paper, in order to flatten the point. If this is not done, a few of the first lines made with it will be hard and wiry.

In making a shade, the lines should always be drawn in one direction. It is especially important that this rule should be observed in case it is necessary to go over a line a second time. In drawing a line, the grain of the paper is forced over in the direction in which the line is drawn. That is, if the line is drawn from left to right, the top of each little prominence on the surface, passed over by the pencil, is tilted to the right. If the pencil is carried over the same ground again, in an opposite direction, these projecting points are tilted the other way; and the result is, the surface of the paper is broken; and, when this is the case, it is impossible to make an even shade.

As to the direction in which shade-lines should be drawn, no rule can be given which can be rigidly adhered to in all cases. We may say, however, as a general rule, that they should take the direction of the surface to be shaded. If the surface represented is horizontal, the lines composing the shade should be horizontal; if vertical, the lines should be vertical; and, if the surface incline, the lines should incline at the same angle that the surface appears to incline.

As faults in shading are unavoidable, especially with beginners, it is important to know how to correct them. Let us here point out a few of the common errors which pupils make, and suggest the remedy.

It is a common error to extend the lines forming the shade beyond the outline of the part to be shaded, so that the edge is irregular and jagged, like the teeth of a saw, instead of being regular and even. To correct this error, place a piece of writing-paper, having a straight edge, over the part of the shade to be preserved, and then apply the rubber. In performing this operation, hold the paper down firmly; for, if it is allowed to move, the chances are, that it will be the means of smutting the drawing.

From various causes there may be dark spots, and occasionally a dark line in the shade, injuring what would otherwise be very good.

To correct this error, cut a bit out of a piece of writing-paper, just large enough to enable one to see the spot or line to be removed through it when the paper is laid over it. Then press the rubber on the part to be weakened, and repeat this operation, occasionally turning the rubber so as to get a fresh spot, until a sufficient amount of lead has been removed to make the spot or line equal in strength to the parts around it.

Pupils not unfrequently make the shade darker than is required. To remedy this, take an old silk handkerchief by the four corners, and slap the drawing forcibly a number of times with the body of the handkerchief. This will lighten the shade by removing a part of the lead.

When it is desired to entirely remove a part, or the whole, of a drawing which has been shaded, the loose lead should first be removed with the handkerchief in the manner suggested above; and, when this has been thoroughly done, the remainder may be erased with the rubber without smutting the paper. In no case should an attempt be made to erase a shade without first dusting it with the handkerchief.

RULES.

LIGHT, SHADE, AND SHADOW.

Rule 1. — *When a receding surface is in shade, the intensity of the shade diminishes as the surface recedes; when it is in light, the intensity of light diminishes as it recedes.*

Rule 2. — *The brightest light is never on the outline of the illuminated side of a cylinder, and the deepest shade is never on the outline of the side in shade.*

Rule 3. — *When an object casting a shadow, and the surface on which it falls, are equally dark, and in close proximity to each other, the shadow is darker than the shaded side of the object casting it. If the surface receiving the shadow is darker than the object casting it, the strength of the shadow is increased.*

Rule 4. — *The strength of a shadow diminishes in intensity as it recedes from the object casting it.*

Rule 5. — *The outline of a shadow is the most clearly defined at the point nearest the object casting the shadow, and it gradually becomes more obscure as it departs from this point.*

Rule 6. — *The outline of a shadow corresponds to the form of the surface on which it falls.*

INSTRUCTIONS

APPERTAINING TO THE EXAMPLES IN BOOK III.

LESSON I.

The objects represented in this lesson are called *cubes.*[*] The object which I hold in my hand is a cube. You will observe that it is bounded by *six plane surfaces.* When a solid is bounded by planes, these planes are called *faces,* and the lines where the faces meet are called *edges.*

How many faces has a cube?

What is the form of each face?

What are the lines where the faces meet called?

Take a book, and hold it upright, directly before you, with the cover facing you, and let the book be raised above the eye.

What parts of the book do you see?

The cover and the lower side of the book are visible.

Turn to Lesson 1, Ex. 1. *Does this drawing convey the idea of a cube seen somewhat as you saw your book?*

Yes.

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[*] The teacher should be provided with a cube of good size to illustrate the points to which the attention of the class is called.

What part of the drawing corresponds to the cover of the book?

The figure ABCD.

What is the form of this figure?

It is square.

Because this figure is square, does it prove that the observer must have had a front view of this face of the cube?

Yes; for only those surfaces which present a front view appear of their actual form.

What is the rule in regard to surfaces which present a front view?

Rule 1. — Surfaces presenting a front view appear of their actual form.

What part of the drawing corresponds to the lower side of the book?

The figure DEFC.

Did you have a front view, or an oblique view, of the lower side of your book?

I had an oblique view.

State the rule which describes the appearance of a surface seen obliquely?

Rule 6. — Surfaces seen obliquely are fore-shortened.

Does the drawing represent the lower face of the cube as fore-shortened?

Yes. The space between the lines DC and EF is very narrow compared with the measure of the line DC.

What relation do the lines DE and CF bear to each other in the drawing?

They approach each other as they recede.

What relation do these lines bear to each other in the cube?

They are parallel to each other.

Why, then, are they made to approach each other in the drawing?

Because parallel lines, receding from the observer, appear to approach each other as they recede, as stated in Rule 4.

What is the actual position of the edges represented by the lines DE and CF?

They are horizontal.

Are these lines horizontal?

No. They incline downward as they recede. All horizontal lines above the eye, receding from the observer, appear to incline downward as they recede, as stated in Rule 5.

Now take your book again, and hold it upright, with the cover facing you, and so that the centre of the cover shall be directly opposite and on a level with the eye.

What parts of the book do you see?

The cover is the only part visible.

What view do you have of the cover?

A front view.

When a surface presents a front view, how does it appear?

It appears of its actual form, as stated in Rule 1.

How would a cube appear if seen as you see your book?

Only one face would be visible, and that would appear of its actual form.

Turn to Ex. 2. *Is the figure HIJK a square?*

Yes.

This figure represents a cube seen as you saw your book. The eye was opposite the point V.

Take your book again, and set it upright on the desk, directly before you, with its cover facing you.

What parts of the book do you now see?

The cover and the upper side of the book are visible.

If your book was in the form of a cube, how would the face corresponding to the cover appear?

It would appear square.

How do you know it would appear of this form?

It would present a front view; and surfaces presenting a front view appear of their actual form, according to Rule 1.

How would the face corresponding to the upper side of the book appear?

It would be fore-shortened.

What do you mean by the term fore-shortened?

I mean, that the distance from the nearest side of the face, to the line bounding the further side, would appear less than the measure of the front side.

What relation would the receding sides of this face appear to bear to each other?

They would appear to approach each other as they recede, as stated in Rule 4.

What would be the actual position of the receding edges?

They would be horizontal.

Would they appear horizontal?

No. They would appear to incline upward as they recede, as stated in Rule 5.

Have you described the drawing given in Ex. 3?

Yes, exactly. This drawing represents the appearance of a cube, seen under the same circumstances in which I saw the book.

Do you observe that the lines representing the receding edges in the upper and lower cubes all tend to the same point?

Yes.

Where is this point?

It is in the centre of the square representing the front face of the middle cube.

In drawing these cubes, then, it will be desirable to place this point before drawing the receding edges, as it will be a guide in drawing these lines.

How are the upright lines in the front faces situated with regard to each other?

They are vertically over each other.

What is the distance between the upper and middle cube, compared with the distance between the middle and lower cube?

The distances are the same.

What is the width of the lower face of the upper cube, compared with that of the upper face of the lower cube?

They are of the same width.

In drawing these examples, are you to make the dotted lines?

No.

Where on the page are these examples to be drawn?

They are to be drawn on the left half of the page, and so that the margin on the left, and the upper and lower margins, will be the same as in the copy.

We now understand just what we are required to do in drawing these examples, and we also understand why they should be drawn as we find them. Let us now consider the best course to pursue in drawing them.

Suppose we draw Ex. 1, then Ex. 2; and, when this has been done, suppose we find that we have erred in judgment, that we have left too great or too small a space for Ex. 3. This would make it necessary for us to erase all we have done, or leave our work wrong. The latter we should never do, so let us look for a better way.

Suppose we place points to indicate the proper place for the extremities of the vertical lines AD, HK, and LP. If we do this, we can see how the work is coming out before the lines are drawn. Let us begin, then, by placing these points, and, when they have been properly placed, we will draw the lines connecting them, beginning with AD. Having drawn these lines, we will complete the front faces, beginning with Ex. 1, drawing them in regular order. Then let us place a point, as V, in the centre of the middle square to serve as a guide in drawing the lines representing the receding edges of the cubes. Next let us consider the distance between the lines DC and EF in Ex. 1, and place a point in our drawing to mark the distance between these lines, and then, through this point, draw a horizontal line, making it of sufficient length to contain the points E and F. Next, keeping the point V in view, draw the lines DE and CF thus completing the outline of this cube.

Having suggested the proper course to adopt in completing the outline of Ex. 1, the best way to proceed with Ex. 3 will suggest itself to you.

You may tell me how you would draw it.

When the class have completed the outlines of the three cubes, the pupils should be required to apply the ruler, or a slip of paper having a straight edge, to the lines representing the receding edges, for the purpose of ascertaining whether these lines point to the centre of the middle square. When this has been determined, the rulers must be laid aside, and the drawing, if fonnd to be faulty, corrected.

In making their drawings, the pupils should not be allowed to measure or rule. The use of ruler or measure should never be allowed until the drawings have been made, and then only by direction of the teacher, for purposes similar to that suggested above.

In order to secure the best results in this study, it is *absolutely necessary* that the class should be *kept together*, that all should be at work on the *same subject* at the *same time*. If, for any cause, a lesson is lost, the pupil should be required to make it up before the next lesson. By adopting this course, the time of the teacher is economized, more instruction may be conveyed and a greater interest awakened, than is possible in any other way. The same reasons which call for class-instruction in reading, writing, or arithmetic, call for it in this study. Allow a certain amount of time in which to do a certain amount of work, and require it to be done within that time. Those who complete their work before the time expires should be sent to the board, and required to draw the example on a larger scale.

If the teacher follows our advice, he will not have his pupils commence shading until they have drawn the outlines of all the examples as far as Lesson 6 at least.

Let us now examine the shade on these examples.

Is the shade on the lower face of the upper cube of uniform strength, or is it a graduated shade?

It is a graduated shade. It diminishes in intensity as it departs from the line DC.

Should the shade on this face be of uniform strength, or should it be graduated?

It should be a graduated shade.

Why should this shade be graduated?

Because the part shaded is designed to represent a receding surface; and, when a receding surface is in shade, the intensity of the shade diminishes as the surface recedes, as stated in Rule 1.

Suppose that the part EF was darker, or even as dark as that at DC, would you in your drawing imitate the example in this respect?

No; knowing how it should be, I should avoid the error.

Examine the shade on Ex. 3, and give me your opinion as to its correctness, and the reasons which lead you to adopt it.

Examine the walls of the room, or any surface that is in shade, and tell me if the lines that bound the surface are darker than the surface.

No: the outline of the surface is no darker than other parts of the surface.

Turn to the examples, and see if they are like Nature in this respect.

If you have made these lines too dark, you must partially erase them before beginning to shade.

In what direction are the shade-lines drawn?

The lines are horizontal.

Why are they made horizontal?

Because horizontal lines convey the idea of a horizontal surface better than lines in any other position; and for the further reason, that the shade can be graduated with more ease, and with greater perfection, by making the lines horizontal, than would be the case if they were made vertical or inclined.

In shading these drawings, would you commence with Ex. 1 *or Ex.* 3?

I should first shade Ex. 1; for, if I began with Ex. 3, it would be quite likely to get rubbed in shading Ex. 1.

You may now begin the shading of the examples in this lesson, being careful to observe all the points to which your attention has been called.

As shade contributes so much to satisfy the eye, pupils are often tempted to hurry on the work too rapidly for success. The teacher, therefore, needs to be constantly on the watch to guard his pupils against this error.

Every line should be drawn with a steady motion of the hand, and so slow that the mind will have time to decide whether it is just where it should be, and whether it is of just the right degree of strength to produce the effect desired. This is a *very important* matter: the success of the pupil depends upon it: hence it should receive the *most careful* attention.

LESSON II.

In this lesson, we have a perspective drawing of three cubes.

Ex. 1. *How many faces of the cube are represented in Ex.* 1?

Three faces.

Name them.

ABCD, DEFC, and BCFH.

What view did the observer have of the face ABCD?

A front view.

How do you know he had a front view of this face?

Because it is represented by a square; surfaces presenting a front view appear of their actual form, as stated in Rule 1.

What view did he have of the face BCFH?

This face was seen obliquely.

How do you know?

Because the face is fore-shortened. Surfaces seen obliquely are fore-shortened, as stated in Rule 6.

What view did he have of the face DEFC?

This face is fore-shortened, and therefore it was seen obliquely.

Were these faces seen equally obliquely?

No: the face DEFC was seen more obliquely than the face BCFH.

How do you know that this was the case?

Because the face DEFC is fore-shortened more than the face BCFH. The more obliquely a surface is seen, the more it is fore-shortened, as stated in Rule 6.

Take a thick book and hold it upright, so that one of its covers shall present a front view; let it be a little on your left, and a trifle above the eye.

What parts of the book do you see?

The cover, the right side, and the lower side of the book.

Is the cube, in this example, represented as being seen somewhat as you see the book?

Yes: it is represented as above the eye, and on the left of the observer; the face ABCD presenting a front view.

What is the actual position of the edges represented by the lines DE, CF, and BH?

These edges are horizontal.

I observe that they are not drawn horizontal in my book: are they in yours?

No: they incline.

Is this correct? Why should these lines incline?

Yes, the drawing is right. All horizontal lines receding from the observer, when above the eye, appear to incline downward as they recede, as stated in Rule 5.

Are all the edges of a cube of the same length?

Yes.

I notice that the lines EF and HF are shorter than DC and BC. How can this be if the edges of a cube are of the same length?

The lines EF and HF represent edges farther in the distance than those represented by DC and BC, and therefore the lines EF and HF should be shorter than DC and BC. Lines of equal length, presenting a front view, when seen at unequal distances, appear unequal; the most distant appearing the shortest line.

What is the length of the line EF, in the drawing, compared with that of HF?

These lines are equal.

Should they be equal?

Yes; because the edges represented by them are equal, they are equally far in the distance, and they both present a front view.

Ex. 2. Take your book again, and hold it so that you can see it as the cube represented in Ex. 2 was seen. Let the cover represent the face IJKL.

Is the book on your left?

Yes.

Is it upright?

Yes.

Do you have a front view of the cover?

Yes.

Is the centre of the book on a level with the eye?

Yes.

What leads you to think that the cube was seen in this way?

One face is represented by a square, and therefore this face must have presented a front view. The right face is represented, and therefore the cube must have been on the left of the observer. The edge JN inclines down at the same angle that the edge KO inclines up; therefore the edge JN must have been just as far above the eye as the edge KO is below it, and hence the eye must have been on a level with the centre of the cube.

Ex. 3. *How was the cube represented in Ex.* 3 *seen?*

It was seen below the eye, on the left of the observer; and the face PRST presented a front view.

Tell me how you know this.

I observe that the lines representing the receding edges in Examples 1, 2, *and* 3, *all tend to one point. Should this be so?*

Yes: because the receding edges are all parallel to each other. Parallel lines receding from the observer appear to approach each other as they recede; and, if sufficiently prolonged, they would meet at one point, as stated in Rule 4.

It cannot be necessary to set down the questions which should be addressed to the class in studying this example. Those which relate to Ex. 1 will suggest what to do in this case. Let them be such as to direct attention to all parts of the drawing, so that its exact form may be known, and question them as to the correctness of the outline.

When the pupils are ready to commence drawing, they should be instructed as to the proper course to pursue in making the outline.

This had better be done, not only in this case, but in every instance, by a series of questions, rather than by a direct statement of the course to be adopted. Let the questions be so formed as to encourage thought on the part of the pupils.

If, in any case, they are not able to decide as to what should be done, then is the time to help them by a direct statement; and this should always be accompanied with reasons for the course recommended. Let this plan be adopted for a time, and the pupils will soon be able, without assistance, to point out the proper course to pursue in making a drawing. The series of questions which follow will furnish an illustration of the course we would adopt.

Suppose you were drawing from an actual cube, seen as in Ex. 1, *which of the three faces seen do you think you would be the most certain of drawing correctly?*

The face ABCD, because this appears of its actual form.

Yes; and for this reason, when drawing from an object, if it has a surface which presents a front view, we should always begin with that surface. If we start right, we may end right; but, if we start wrong, we must inevitably end wrong. In drawing from a copy, we should always pursue the same course that we would take in drawing from the object represented, that we may form correct habits. In drawing these examples, then, let us begin with the front faces. To place our drawings on the page, just as the examples are placed on the paper, will require some calculation.

How did we proceed in Lesson 1?

What were the reasons which induced us to adopt this course?

Do these same reasons apply to the examples given in this lesson?

Shall we proceed in drawing the front faces of these examples as we did in drawing the corresponding faces in Lesson 1?

Let us suppose the front faces drawn. Now we will consider what course we had better pursue in completing the drawings.

In completing Ex. 1, we can draw the inclined lines representing the receding edges, and then the lines EF and HF; or we can reverse the order, and begin with EF and HF. If we adopt the latter course, you will observe, that, in drawing EF and HF, we get the point F, one extremity of the line CF; and, since we have C, it will be an easy matter to get this line.

Which course had we better adopt?

Evidently we shall be more certain of accuracy if we begin with the lines EF and HF. To draw a line of a given length, inclining at a given angle, is far more difficult than to draw a horizontal or a vertical line of indefinite length, at a certain distance from another line.

In drawing the line HF, what is the first thing to consider?

Its distance on the right of BC is the first thing to be determined.

Suppose, then, we determine this, and place a point on the right of BC, to mark the distance between these lines, and through this point draw a vertical line of sufficient length to contain the points H and F, without being especially careful to make it of just the right length.

In drawing EF, how shall we proceed?

Consider the distance of this line below DC, and place a point to mark the distance between these lines; and then, through this point, draw a horizontal line to meet HF, making it sufficiently long to contain the point E.

What is to be done next?

Connect the points C and F.

Compared with DC, how long is the line EF?

It is shorter.*

This will be something of a guide to us in placing the point E.

Under what point in the line DC does the point E come?

It is directly under the point Y.

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* No rule can be given that will enable us to tell just how much shorter EF should be than DC. The apparent length of these lines, as compared with each other, depends upon the distance of the cube from the observer. If the cube is at some little distance, the difference will be but a trifle; if the observer approaches the cube, the difference will be increased as he advances. Having fixed upon the length to be given to EF, the correctness of the drawing must be determined by the idea conveyed by it. If the line is too long, or if it is too short, the figure DEFC will not appear square.

Is the distance from Y to D greater or less than the distance of C from the vertical line HF?

The distance from Y to D is greater.

Is the line EF just as much shorter than DC as the distance from C to HF is less than DY?

Yes, exactly.

If you were asked to give an opinion as to the exact difference between DC and EF, would you compare the whole of DC with the whole of EF, or would you compare DY with the distance between C and HF?

I would take the latter course.

Why?

Because, when lines of unequal length are at some little distance from each other, the difference in length is made more apparent by an equal shortening of the lines.

In completing the lower face of the cube, how shall we proceed?

First place a point, as Y, in the line DC, a little farther from D than C is from HF; next place a point, as E, in the indefinite line EF, directly under Y; and then draw DE.

In determining the length of HF, can we adopt a course similar to the one taken in determining the length of EF?

Yes.

You may tell us how this may be done, and how to complete the figure.

Place a point, as Z, in the line BC, at a distance from B a trifle greater than the distance from C to EF; and then, in the indefinite line HF, place a point, as H, on a level with Z. This will make the distance from H to F as much shorter than BC, as the distance between C and EF is less than BZ. Having determined the point H, it only remains to connect the point with B to complete the outline.

How shall we proceed in completing the outline of Ex. 2?

Consider the distance of the line NO on the right of JK, and place a point to mark the distance between these lines; and through this point draw a vertical line of indefinite length, being careful to make it sufficiently long to contain the points N and O. Next consider what point in the line JK the point N is on a level with, and then place a point, as M, to mark this point; next, in the indefinite line NO, place a point, as N, on a level with the point last placed, and then draw JN. In placing the point O proceed as in placing the point N. Then draw KO.

Does the drawing of Ex. 1 *suggest the proper course to pursue in drawing Ex.* 3?

Yes.

Point out in detail the course you would take in drawing this example.

When the pupils have completed the outlines of these examples, they may apply a straight-edge to the receding lines, for the purpose of testing their accuracy. The lines SX and BH may be produced until they meet: those lines should be made very light and continuous. It will not be necessary to extend the other lines. I would advise that all of the pupils be required to do this at the same time.

Before adding shade to your outlines, let us learn all we can from the examples.

Can you tell from the examples whether the light came in on the right or on the left of the cubes?

Yes: the right faces being in shade, shows that the light came in on the left.

Was the sun in front of the cubes, or behind them?

The absence of shade on the front faces shows that the source of light was in front of them.

What does the shade on the lower face of Ex. 1 *show as to the height of the sun?*

It shows that the sun was above the level of this surface: if it had been below, the surface would not have been in shade.

What is the law in regard to the appearance of shade on a receding surface?

The intensity of the shade appears to diminish as the surface recedes.

Has this law been observed in shading these examples?

Suppose that this law had not been observed, would you follow the copy, or would you be guided by the law?

We ought to be guided by the law rather than by the copy.

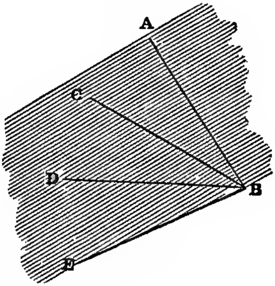
Examine the upper face of Ex. 3. You observe that it is a little darker than the front face. This light tint is not intended to represent a shade, but a light less intense than that on the front face.

The light being low in this case, the rays fall more obliquely on the upper face than on the front face; and this makes the former less brilliant than the latter.

The teacher should show the truth of this statement by experiment.

Place a book so that the rays of light shall fall perpendicularly upon one of its covers, and call the attention of the pupils to the intensity of the light. Then gradually turn the book so that it shall receive the rays more and more obliquely. The difference between the two extremes will be quite noticeable.

That the intensity of a light depends on the angle at which the rays fall upon a surface may be clearly shown by a figure like that here given.



Let the light lines in this figure represent rays of light, and let AB be a surface placed perpendicular to the rays. Observe that *all* of the rays fall on this surface. Now suppose the surface AB to be turned a little from the light, so that the rays will strike it obliquely, and let it be represented by CB. In this case, you perceive that only a part of the rays fall on it, and hence the light on the surface is not so intense. Suppose it to be turned so as to receive the rays still more obliquely, and let it be represented by DB. In this case, fewer rays fall on the surface than was the case when it was placed at CB, and therefore the illumination is less brilliant. The truth illustrated by this figure may be stated thus:—

A surface has its highest light when the rays are perpendicular to it: if the rays strike it obliquely, the illumination is less intense; and, the more obliquely the rays fall upon the surface, the more subdued is the light.

There is another matter connected with the shading of these examples which demands our attention. You will observe, in Ex. 1, that the lower face is not as dark as the right face; and yet both of these surfaces are in shade. This difference is produced by *reflected light.* The upper face of the middle cube is illuminated, and, being near the lower face of the upper cube, the reflected light is quite strong.

To illustrate the effect of reflected light on a surface in shade, let the teacher place a sheet of white paper in a strong light, and then hold a book so as to receive the reflected light on the cover. As the book is brought near the paper, the effect will be clearly apparent.

What is the rule as to the direction in which shade-lines should be drawn?

As a general rule, the lines forming a shade should have the direction of the surface to be shaded.

Has this rule been observed in shading these examples?

LESSON III.

Ex. 1. — The figure represented in this example is called a *parallelopipedon.*

A parallelopipedon has six faces, and those opposite to each other are of the same size and form.

This figure is represented as it would appear if placed on the right of the observer, and below the eye, with the face ABCD presenting a front view. Place a book on the desk, a trifle to your right, with the back presenting a front view, and you will see the book somewhat as this object was seen.

It cannot be necessary to set down the questions which should be put to the pupils before drawing this example. Lessons 1 and 2 will suggest the proper course to pursue in all cases of this kind. The numerals connected with the example indicate the order in which the lines should be drawn. The purpose of the dotted lines HK and FJ is to assist in determining the proper place for the points H and F. These points are found as the points E and H were found in Ex. 1, Lesson 2. In drawing the lines HK and FJ, they should not be dotted: make them *very light*, and, when the outline is complete, erase these lines.

In examining the drawing of the pupils, whenever an error is detected, the pupil should *never* be referred to the copy to prove the incorrectness of his work, but to the laws which apply to that part of the drawing; and this should be done, as we have advised in previous lessons, by questioning him in such a way as to lead him to detect his errors, and to suggest the remedy.

Ex. 2. — This example represents a box, with a partition dividing it into two equal parts. It will be observed that the general form of this box is like the figure given in Ex. 1. This subject was selected because it contains quite a number of parallel lines receding from the observer. In my own experience as a teacher, I have found that pupils are more likely to violate the rule relating to receding parallel lines than any other. It is only by watchfulness on the part of the teacher, and by continued practice in drawing them, that they will learn to observe the rule. See that the pupils do not make the lines defining the parts too heavy. It is *especially important* that those should be light which bound the parts in shade. They must not be seen as lines when the shade has been added.

In drawing from an object, we should always sketch the main form before adding a line of detail; and therefore pupils in drawing from a copy should be required to do the same, that they may form correct habits.

In drawing this example proceed as in drawing Ex. 1. Then draw the lines which represent the thickness of the boards of which the box is made; next draw the lines which represent the upper edges of the board which forms the partition; then make the vertical lines formed by the meeting of the partition and the end of the box, with the board forming its farther side: this completes the outline.

When the pupils are ready to shade their outline, call their attention, *by questions*, to the truths of shade and shadow, and then to the example, to learn how these truths are there expressed.

In shading, always proceed with the work so as to keep the hand off of what has been done.

LESSON IV.

In drawing these examples, the dotted lines are not to be made until the outline is complete. When this is the case, the lines representing the receding edges may be extended, for the purpose of testing the accuracy of the drawing so far as regards the direction of these lines. In extending the lines, use a ruler, and let the lines be made *very light.* In Ex. 1 we have a case which is likely to prove perplexing to the beginner in drawing from objects, unless the truths connected with it are well impressed upon the mind by some such illustration as we have here given. We refer to the edges represented by the lines AB and BK. These edges are actually perpendicular to each other; but being horizontal, and on a level with the eye, they appear to form one straight horizontal line, as here shown.

As a hint to the teacher, we give a few questions and answers relating to the examples in this lesson. The questions addressed to the class should go into the matter more in detail. Their attention should be called to every truth connected with the drawings, before they make a line.

Ex. 1.—*How was the object here represented situated with regard to the observer?*

It was on his left, the part represented by the lines AB and BK was on a level with the eye, and the face in light presented a front view.

How do you know that the part represented by the lines AB and BK was on a level with the eye of the observer?

The line BK represents a receding edge, this edge was horizontal; and, since BK is horizontal, it follows that this edge must have been on a level with the eye.

State that part of the rule which applies to horizontal lines on a level with the eye receding from the observer.

I observe that the distance between the lines BC and KL is not as great as between the lines FJ and NO; and yet the actual distance between the edges represented by these lines is evidently the same. Is the drawing correct or incorrect in this particular?

The drawing is correct: the face BKLC was seen more obliquely than the face FJON, and therefore the former would be fore-shortened more than the latter.

If this fact is not clear to the class, illustrate it in this way: let them take a book, and hold it upright directly in front of them, and so that its covers shall recede directly from them. Then let them move the book a trifle to the left, which will bring one of the covers into view. The cover of the book, as now seen, may represent the face BKLC. Now move the book still farther to the left: this causes the cover to appear wider than before, and the cover, as now seen, may represent the face FJON.

State the rule which applies in this case.

What is the length of AB compared with AD?

What is the distance from D to E compared with AD?

What is the distance from E to F compared with the distance from E to D?

What is the distance from F to C compared with the distance from F to E?

How long is EH compared with AD?

In drawing an object in which there is a prominent part presenting a front view, what course have you been instructed to take in commencing the drawing?

Our instructions are to begin with the part presenting a front view.

What reason was given for this?

How is this example to be drawn?

First draw the figures representing the front face. Then determine the distance of KL on the right of BC, and place a light dot to mark the distance between these lines; and then, through this point, draw a vertical line, of sufficient length to contain the points K and L. Next draw BK, making the line horizontal. Then determine the length of KL, by ascertaining the height of the point L above the level of C, and draw CL. Next determine the distance of NO on the right of FJ, and place a point, as N, in the line DC, to mark the distance between these lines; and from this point draw a vertical line, of sufficient length to contain the point O. Then determine the height of O above the level of J, and draw JO, which completes the outline.

Before the shade is added to the outline, question the pupils as to what they intend to do, what their reasons are for doing as they propose, and what course they intend to take to accomplish what they design to do.

Ex. 2. — *How was the cross here represented situated with regard to the observer?*

It was below the eye, on his left.

What is there about the drawing that leads you to believe that this was the case?

Question the pupils as to the actual proportions of the several parts of the cross. Call their attention to the difference between the actual form and the apparent form; and, before the shading is commenced, question them in regard to the facts, and the means to be used in expressing them.

How is this example to be drawn?

First draw the front face of the cross. Then determine the height of the line PR above FH, and draw the line PR, of sufficient length to contain the points P and R. Next consider the distance of the line RS on the right of HJ, and draw RS. Then draw HR. Next place a point, as P, in the line PR, at a distance from R a trifle less than the measure of FH, and then draw FP. Before proceeding farther with the work, especial care should be taken to determine the accuracy of what has been done, as that which follows is to be based upon it. When satisfied of its correctness, guided by FP and HR, draw JS, so that it will tend to the point to which these lines tend. Then draw ST, of sufficient length to contain the point T. Next, keeping in view the lines FP, HR, and JS, draw BT. Then in the line FE place a point, as X, on a level with S, and draw OX, of sufficient length to contain the point O; and then, guided by the receding lines already drawn, draw AO. Next draw TU, of sufficient length to contain the point U. Then, keeping in view the receding lines, draw CU. In the line DC place a point, as Z, vertically under S; then draw ZW, of sufficient length to contain the point W; and then, guided by CU, BT, &c., draw NW.

LESSON V.

In drawing from an object, as we have remarked in a previous lesson, we should first sketch in, very lightly, its main outline; paying no regard to the detail. Examples 1 and 2 are given to illustrate the method we would adopt in drawing a book. In these examples, it will be observed that all of the lines are straight. Ex. 1 gives the general outline of a book seen as represented in Ex. 3, and Ex. 2 that of a book seen as represented in Ex. 4. The numerals indicate the order in which the lines should be drawn. After the general outline has been sketched in, as here shown, it should be carefully examined to determine its correctness; and, if found to be correct, the details should be added, beginning with the most prominent parts. By taking the course here recommended, a great deal of time, labor, and vexation is avoided. It is not intended that Examples 1 and 2 should be drawn.

Ex. 3 — This example represents a book directly in front of the observer, and below the eye. Before drawing this example, require the pupils to place a book on the desk, so that it may be seen by them as the book here represented was seen, and question them fully in regard to the appearance of all its parts.* Call especial attention to the fact that the centre rib on the back of the book, although a curved line, appears to be *perfectly straight.* This is owing to its being directly in front of the observer, and in a plane receding directly from him. Let the pupil take a cup or tumbler, and hold it so that the circle formed by the rim shall be vertical, directly in front of him, and recede directly from him, and he will find that there is not a point in the outline of the rim to be seen on the right or on the left of any point in the line which he may select; or, in other words, he will find that the line appears to be perfectly straight. The cup may also be used to illustrate the apparent direction of the curves formed by the ribs on the right and on the left of the one we have just considered.

In shading the back of the book, especial care should be taken to grade the shade perfectly, and to have it melt away into the light so delicately, that its termination shall not be noticed. To make a very faint shade, the pencil should be held so that its point shall be some two or three inches from the ends of the fingers.

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* The course here recommended should always be adopted when possible. In making our selection of subjects, we have given many drawings of books, so as to make it possible for the pupil to place his book, or books, as the case may be, so that he may view them as the examples represent them as being seen.

It will be observed that the lines forming the shade on the back of the book are drawn parallel to the straight sides of the back. This is much the easiest way to shade a surface of this kind. It would require a skilful hand, more care, and more time, to shade this surface by making the shade-lines in the opposite direction; and there would be nothing gained by it.

Let this example be drawn in the middle of the upper left-hand quarter of the page.

It is presumed that the pupil is now sufficiently familiar with the principles of perspective to warrant his making an attempt to draw occasionally from objects. At first, let him practise on the slate, or on a bit of writing-paper; and, when he succeeds in getting a tolerably correct outline, it may be drawn in the copy-book, on that part of the page usually devoted to the second drawing of the examples. Let the object selected for his first trial be a book; and to make the work as easy as possible, it being his first effort, let the book be placed on his desk so that he may see it somewhat as the book represented in Ex. 3 of this lesson is seen.

Ex. 4. — Before drawing this example, that part on the left representing the end of the book should be carefully studied. Observe that the upper and lower covers appear to project beyond the leaves. This drawing, and all others representing books, should be studied in connection with books seen as represented in the drawings.

Place a book so that it may be seen as the one here represented, and thoughtfully compare each line in the example with the corresponding line in the book.

In drawing the outline, especial care should be taken to make the curved line defining the edge formed by the leaves very light. If this line is visible after the shade is added, it will entirely destroy the character of the drawing. It will not appear like a book made up of many slips of paper that may be opened anywhere: it will appear like a solid block.

Observe that the direction of the lines forming the shade, on that part of the drawing representing the leaves of the book, corresponds to the direction of the lines formed by the leaves. By drawing the lines in this direction, we not only represent a surface in shade, but we also express the *character* of the surface shaded. Draw Ex. 3 in the middle of the upper left-hand quarter of the page, and Ex. 4 in the middle of the upper right-hand quarter. The two drawings will then appear as parts of the same picture. As they stand in the copy, they are independent pictures. In making a second drawing from these examples, let the books be drawn as they would appear if seen farther below the eye than they are represented to be in the examples, all other circumstances being the same. The only change in their outline would be in the apparent width of the covers; being seen less obliquely, the foreshortening would not be as great as in the examples..

LESSON VI.

Before questioning the pupils on the examples given in this lesson, have them place books as here represented. In both cases, the books are on the right of the observer, and below the eye. Observe that the receding edges are parallel to each other, and that the lines representing them all tend to the same point. In drawing the examples, first make a general outline, as in Examples 1 and 2, Lesson 5; and, when this is perfected, add the detail. In both cases, begin with the upper book. The remarks in the previous lesson which refer to the line representing the edge formed by the leaves of the book, and to those used in shading the surface formed by the leaves, apply with equal force to the corresponding lines in these examples.

After the examples have been drawn, let the pupils place books in some easy position, and draw from them; and, when they have as perfect an outline as may reasonably be expected from them, let it be re-drawn in the drawing-book on the right half of the page.

Beginners, in drawing from objects, almost invariably under-estimate the foreshortening of surfaces seen obliquely; and therefore they need to be repeatedly cautioned to be on their guard, lest they fall into this error.

The examples in the drawing-book will suggest to the pupil how he may shade his outline.

LESSON VII.

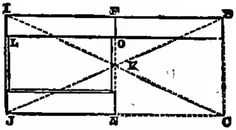
We have selected an open chest as the subject of this lesson, in order to call attention to a common error in drawings of this kind, and that we may point out the means by which this error may be avoided. The error to which we refer consists in making the cover either too large or too small for the chest. Since the cover is farther in the distance than the body of the chest, it is perfectly obvious that its apparent width will be less than that of the chest; but just how much narrower it should be is not so easily determined if one depends upon the eye alone to decide the question.

Ex. 1.—In this example we have the general outline of the chest represented in Ex. 2.

How is this example to be drawn?

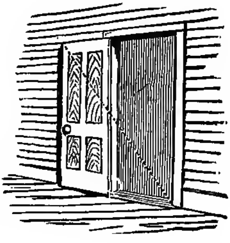
First draw the lines defining the body of the chest in the order indicated by the numerals. Next place a point, as K, in the middle of the line FN. Then extend the line BF so that the point I shall come in a line with the points K and C. When this is the case, the distance from I to F will be *apparently* equal to BF; and this is what is required. In completing the drawing, proceed as indicated by the numerals.

To make it clear to the class that the means here employed to determine the width of the cover will make it apparently equal to that of the chest, let the teacher draw on the board the *actual form* of the end of the chest, inscribing it within a rectangle, as shown in the accompanying figure. They will then see that a right



line drawn from C through K, the centre of FN, intersects BI at a point as far from F as F is from B.

This method of determining the true perspective width of the cover of the box is often of service in drawing other objects. In sketching a door and doorway, for example, when the door is thrown back against the wall, as in the accompanying drawing, it may be employed in



determining the apparent width of the door as compared with the doorway. Indeed, there are many cases which will doubtless suggest themselves to the teacher, where it may be used to assist in determining the true perspective width of surfaces. The attention of the class ought to be called to this fact, and illustrations should be given on the board to impress it upon the mind.

Ex. 2. — *How is this example to be drawn?*

Proceed as in Ex. 1, and then add the detail as suggested by the instruction given under the head of Ex. 2, Lesson 3, page 54.

If we often repeat the advice to question the class in regard to every part of the example to be drawn, before they attempt its execution, it is because our own experience as a teacher has led us to see the absolute necessity of pursuing this course. The *real* success of the class depends upon it. It puts the teacher in possession of the mind of his pupil; and he sees at once whether the instruction which has been communicated is retained, or whether it has been forgotten. He learns just what the pupil knows, and what he lacks which he ought to know in order to proceed with his work intelligently; and this gives the teacher an opportunity to render assistance where it is needed. The importance of thoroughly questioning the pupils in regard to their work cannot be over-estimated.

There is another bit of advice which has already been given, but which we desire to repeat, because of its importance; and that is this: *Never allow the pupil to appeal to his example to prove the correctness of his drawing.* If it is right, he must show it to be so by appealing to the laws of Nature involved in its construction; and, if it is wrong, the error must be made apparent by calling his attention, by question, to the law which he has violated.

After the examples in this lesson have been drawn, we would recommend that the class be sent to the board, and required to draw the outline of Ex. 1 from *memory*, and number the lines in the order in which they are drawn. When this has been done, number the drawings so as to distinguish them from each other, and let them be criticised by the class, both as to the correctness of their outline, and as to the course adopted in drawing it.

This is a valuable exercise, and it should be frequently practised. Errors will be committed; and the discovery and correction of them will be of great service to the pupils.

LESSON VIII.

The examples given in this lesson will clearly show the advantage of first securing the main outline of the object to be represented, before any attempt is made to get the outline of the parts. If the pupil were to attempt to draw the chair represented in Ex. 2, without doing this, he would find it no easy task; but let this be done, and he will meet but little difficulty in producing a creditable drawing.

Ex. 1.—In this example we have the general outline of the chair of which Ex. 2 is a drawing. In drawing this example, let us suppose ourselves working from the actual chair, that we may the better understand how to proceed in drawing from an object of this kind.

How shall we proceed in drawing the general outline of the chair?

First draw the line *ab* to represent the position and length of the nearest front leg. Then consider the width of the seat, that is, the distance from A to D; the width of the seat being equal to the measure of the front leg, draw *ad* equal to *ab*. Next consider the height of the back of the chair compared with the distance of the seat from the floor. These two measures being equal, draw *ec*; making the parts *de* and *dc* equal. Next draw *bc*: this line is simply a *guide-line*, the purpose of it being principally to assist in determining whether the point *c* has been correctly placed. It also serves as a guide in drawing the rounds on the nearest side of the chair. The general outline of the nearest side being complete, consider how far the leg JK appears to be on the left of AB, and, having determined this, place a point to mark the distance, and draw the line *jk*, of indefinite length. Next determine the apparent height of the farther side of the seat above AD, the nearest side, and then draw *jn*, of indefinite length. Next draw *ja*. The point K, in the leg JK, seems to be above the level of B, the corresponding point in the nearest leg; observe its apparent height, place the point *k*, and draw the guide-line *kb*. Especial care should be exercised in placing the point *k*; for, in completing the drawing, it is assumed to have been correctly placed, and the pupil is governed by it in drawing other lines. The side DN of the seat being parallel to AJ and to a line connecting the bottom of the front legs, it will appear to tend towards the point to which these lines tend. Guided by *aj* and *bk*, draw *dn*. Next consider the apparent length of the post FH. Observing that the end H is on a level with K, and that the apparent distance from N to F equals

NH, draw *fh*, placing *h* on a level with *k*, and making *fn* equal *nh*. Finally draw the guide-lines *kh*, *hc*, and *fe*.

Too much attention cannot be paid to the order in which the lines are taken up in these examples; for this will tend to secure an intelligent method of procedure when the pupil is left to decide this matter for himself.

Ex. 2. — In drawing the outline of the several parts of the chair, begin with those nearest the observer. As we have before remarked, this plan should, in general, be adopted in drawing from objects. The rounds of the chair should be carefully drawn, their true proportion to the other parts be preserved, the proper direction given to them, and great pains should be taken to secure a correct drawing of that part where they are seen to enter the legs of the chair. Observe that the lines used to represent the material with which the chair is bottomed are curved somewhat, to represent the sagging of the seat.

This example is an excellent one for the pupils to draw on the board from memory.

LESSON IX.

In the previous lessons, some prominent part of each object has presented a front view to the observer; but, in this lesson, the objects represented are so placed, that each surface visible is viewed obliquely. When objects are thus seen, they are said to be in *oblique perspective.*

Ex. 1. — In this example we have a general outline of the book represented in Ex. 2. That the pupils may clearly understand just how this book was seen, let them place a book on their desks so that the part corresponding to AB in the drawing shall be nearest to them, and so that the part corresponding to EF shall be farther in the distance than that corresponding to CD. Then let the cover of the desk be raised so as to make it horizontal, and their view of the book will be similar to that which the observer had of the one represented in the drawing. When this has been done, call the attention of the class to the fact that the points A, C, E, and H in the drawing of the upper cover, and the corresponding points in the lower cover, vary in height according to the distance of the points which they represent from the observer; the points representing the nearest points in the covers being the lowest, and those representing the most distant being the highest. To show that the book is correctly represented in this particular, call to mind the fact that receding horizontal planes, when below the eye, appear to incline upward as they recede; and therefore the nearest points must appear to be the lowest, and the most distant the highest.

In drawing the general outline of a book, seen as the one represented in Ex. 2. *what is the proper course to pursue?*

First draw a vertical line, as *ab*, Ex. 1, to represent the part AB of the book. Then consider how far the part CD appears to be on the left of AB, and draw a line, as *ck*, of indefinite length. Next consider how far the part EF appears to be on the right of AB, and draw a line, as *el*, of indefinite length. Then, through *b*, draw a *very light* horizontal line, as *kl*, to assist in properly placing the points to represent D and F. Then, taking the pencil by one end, hold it horizontal, and facing you, and so that the point represented by B may be seen over the pencil, as *b* is seen in *kl*. When this has been done, consider the apparent height of the point D above the pencil, and, having fixed upon this, place a point, as *d*, in the indefinite line *ck*, to mark the apparent height of this point; and then draw *db*. Again: hold the pencil as before, and consider the apparent height of F above the pencil, and, when this has been determined, place a point, as *f*, in the indefinite line *el*, to mark the apparent height of this point; and then draw *bf*. Next, bearing in mind that the part CD is farther in the distance than AB, consider its apparent length as compared with AB, and place the point *c*, in the line *ck*, so as to make *cd* less than *ab*; and then draw *ca*. Next, bearing in mind that the part EF is farther in the distance than CD, consider its apparent length as compared with this line, and place a point, as *e*, in the line *el*, so as to make *ef* less than *cd*; and then draw *ae*. Then, bearing in mind that the side CH of the cover is parallel to the sides AE and BF, start at *c*, and draw *ch* of indefinite length, and bearing such a relation to the lines *ae* and *bf*, that, if the three lines were produced in the direction of their convergence, they would meet at the same point. Next, consider what point in the line AE the point H seems to be vertically over. To assist in determining this point, hold the pencil vertically between the eye and the point H, and see where the pencil seems to intersect the side AE of the cover. Having determined this, place a point, as *j*, in the line *ae*, to mark this point; and on *j* erect a vertical line to meet *ch*; and from the point *h*, thus determined, draw *he*, which completes the general outline of the book.

Since the sides BD, AC, and EH of the covers, are parallel to each other, the lines *bd*, *ac*, and *eh*, in the general outline, on being produced in the direction of their convergence, must meet at the same point, if the drawing is correct. In case it is evident that these lines, on being produced as suggested, will not meet at the same point, it follows that the outline is incorrect, and needs to be considered again.

After Examples 1 and 2 have been drawn, let the pupils test the knowledge acquired in this lesson by drawing from a book, or some simple object seen in oblique perspective.

LESSON X.

Ex. 1. — In this example, one of the objects represented is in parallel perspective, and the other is in oblique perspective. The lower book is seen as the one represented in Ex. 3, Les. 5, and the upper one is seen as the one in the lesson immediately preceding this. Having already given full instruction as to the proper course to pursue in drawing these books when taken singly, it will only be necessary for us to suggest the proper course to pursue when taken together. Begin with the lower book, and, in drawing the upper line in the back, pay no regard to the fact that a part of it is not seen; draw the line entire, and erase the part not wanted when the outline of the upper book has been made. In drawing the lines in the lower cover of the upper book, take the upper line in the back of the lower book as a guide.

This example will give the teacher an opportunity to call the attention of the class to the value of shadows in a drawing. Observe that the right corner of the lower cover of the upper book appears to be raised from the cover of the book on which it rests. You can seem to see under this part of the book. This effect is due entirely to the shadow under the cover.

Notice that the nearest corner of the upper book appears to jut over the back of the lower book. It is the shadow just under the corner that produces this effect. Special attention should be given to the form of this shadow.

Ex. 2. — In drawing the outline of this book, see that the rule which relates to receding parallel lines is observed, and pay particular attention to the drawing of the shadows. After what has been said in previous lessons, the use of the guide-lines given in this example will be obvious.

LESSON XI.

The objects represented in Examples 1, 2, and 3 of this lesson are called *cylinders.*

What is a cylinder?

Strictly speaking, a cylinder is a circular body of the same diameter throughout, and the circles formed by its extremities are perpendicular to its *axis;* but, in common language, any circular body of the same diameter throughout is called a cylinder.

What are the circles formed by the extremities of the cylinder called?

They are called the *bases* of the cylinder.

What is the axis of a cylinder?

It is a line joining the centres of its bases.

Ex. 2 represents a cylinder directly in front of the observer, with its bases receding directly from him. Ex. 1 represents a cylinder on the left of the observer, with its bases parallel to those of Ex. 2. Ex. 3 represents a hollow cylinder on the right of the observer, with its bases parallel to those of Ex. 2.

When a circle is seen obliquely, its apparent form resembles an ellipse. The figure is not an ellipse, however; for, in the ellipse, the long diameter divides the figure into equal parts, which is not the case in the figure which represents the exact appearance of a circle seen obliquely. Take the case of the circle represented in Ex. 1. In the circle AHBC, the half AHB is farther in the distance than the half ACB; and, since objects appear to diminish in size as their distance from us increases, it is evident that the half AHB must appear smaller than the half ACB. The distance from H to the diameter AB must appear less than the distance from C to AB. *In representing a circle seen obliquely, the half more distant should always be made a little smaller than the half nearer the observer.**

To illustrate the appearance of a circle seen obliquely, make use of a hoop. Hold the hoop horizontal, and on a level with the eyes of the pupils, and its appearance will be that of a straight line. Raise it or lower it, and it assumes a different form. Question the class as to the changes which take place in its apparent form as it is raised or depressed. Hold the hoop in a vertical position, and bring it on a line with the eye of some one of the class in the centre of the room, and question that one, and others on his right and left, as to its appearance, and call for the reason why the figure which it describes appears wider to one than to another.

It will be observed that the distance from E to A, and from F to B, in Examples 1, 2, and 3, is less than the distance from D to C. The actual distance between these points is the same; but the parts EA and FB being farther in the distance than DC, they appear to measure less than DC.

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* There are other points of difference between the ellipse and the figure formed by a circle seen obliquely; but we do not deem it advisable at this stage of the pupil's progress to call attention to them. Our plan is to direct attention first to the most obvious truths, leaving those which are not so readily seen to be considered when the pupil is farther advanced.

If each member of the class will provide himself with an object like that represented in Ex. 1, it will be of assistance in studying this lesson, and it will also be of service as a model to draw from. One of those little circular blocks such as ribbon is wound on will serve the purpose admirably.

In drawing a circle seen obliquely, it is a common error to make the parts corresponding to A and B in Ex. 1 *pointed*, like a Gothic arch. There is no appearance of an angle in the outline of a circle, however seen. The sweep of this line should be thoughtfully considered before the pupil undertakes to draw it.

Ex. 1. — *How should we proceed in drawing the outline of a cylinder seen as the one represented in this example?*

First draw a vertical line, as AB, as a guide in drawing the base represented by the curved line ACBH. Next consider the measure of the part EA, compared with the distance from A to B, and draw EA. Then draw the guide line EF, and then FB. Next consider the apparent width of the base ACBH, compared with its height, and place points, as C and H, to mark its width, making the distance from C to I a little greater than the distance from H to I. Then draw the outline of the base ACBH. Next place a point, as D, making the distance from D to C a little greater than the distance from E to A; and then, guided by the straight line EF, and the curved line ACB, draw that part of the base represented by the line EDF.

Ex. 2. — *How should we proceed in drawing the outline of a cylinder seen as the one represented in this example?*

First draw a vertical line, as EF, the length of which will depend, of course, upon the proposed size of the drawing. This line represents the vertical diameter of the base represented by the curved line EDF, and also serves as a guide in drawing that line. After drawing EF, consider the length of the cylinder, compared with its diameter, and draw EA. Next draw the guide-line AB, and then draw FB. When this has been done, place points, as D and C, making the distance between these points a little greater than the measure of EA. Then, guided by the line EF, draw the curved line represented by EDF; and then, guided by AB, draw the curved line represented by ACB.

Ex. 3. — In studying this example, call special attention to the relation which the inner line of the rim bears to the outer line. It will be observed that these lines are not parallel to each other in the drawing, as they are in the object. The distance from A to I, and from J to B, is greater than from K to L; and the distance from K to L is a trifle less than the distance from O to N. The reason of this will be obvious when it is considered how these parts of the object are seen. Conceive lines connecting the points AI, KL, JB, and ON. These lines in the object would be equal; but AI and JB would present a *front view*, whereas KL and ON would be seen *obliquely:* and therefore AI and JB would appear longer than KL and ON. And then, again, since KL is farther in the distance than ON, KL would appear shorter than ON; and hence the two lines which are actually parallel to each other in the object would appear as here represented.

How should we proceed in drawing the outline of a hollow cylinder seen as the one here represented?

Draw the main outline of the cylinder as suggested by the instruction given in drawing Ex. 1. Then consider the thickness of the cylinder, and place points, as I and J, in the vertical diameter; then place points, as L and O, and through these points, guided by the curved line AKBN, draw the curved line ILJO.

Before shading the outline of this example, call the attention of the class to the truths connected with light and shade on cylindrical forms, and have them commit to memory the rule in which these truths are stated. Let the pupil take some cylindrical object, and view it by lamplight, and the peculiarities of the light and shade on its surface will be more noticeable than will be the case if the object is viewed by sunlight. If the object selected be a round box, like a strawberry-box, it will give him the means of studying the shadows that may be cast on its inner surface by the side of the box nearest the light. Direct him to notice the form of the shadows that may be produced by placing the box in different positions; let him also observe what parts of the outline are the most clearly defined, and, further, what parts of the shadow are the most intense.

Ex. 4. — In this example we have a subject involving the same general principles as the cylinder. This drawing affords a good illustration of the value of shadows in expressing the truths of form. The shadows cast by the stick on the outer and inner surface of the tub clearly indicate the form of these surfaces. That on the inner surface shows it to be smooth and circular, while that on the outer surface indicates the projection and form of the hoops. It shows that one of them is round, and that the others are flat. Observe that the outline of the shadow on the round hoop is curved, and that, on the flat hoops, it is made up of straight lines.

On examining the shadow cast on the hoops by the stick, it will be observed that the shadow is the darkest on the upper side of the hoops. This is owing to the fact that the broad side of the hoops receives more reflected light than the upper side.

Notice the form of the shadow cast by the hoops, immediately under K, and place a circular box, with its cover on, in a strong light, and observe a similar shadow cast by the cover on the side of the box, just where the light and shade blend together.

Examine the shadow on the inner surface of the tub, cast by the side towards the light, and observe that its outline is the most clearly defined at the point nearest the highest light. Show that the drawing is like nature in this respect, by placing a round box in a strong light so as to receive a shadow as shown in the example.

Observe that the lines which indicate the staves of the tub are not as decided in the highest light and deepest shade as they are in other parts of the tub. *The minute detail of an object is the most clearly visible on those parts where the light and shade blend together. In the highest light and in the deepest shade, all minor detail is invisible.*

In drawing from an object like the one represented in this example, how should we proceed?

First draw a light line, as AB, as a guide in drawing the outline of the rim. Then, comparing the height of the tub with the distance from A to B, draw a vertical line, as AD, to indicate its height. This line also serves as a guide in determining the slant of the side AJ. Next draw BC equal AD, and then draw DC. The line DC serves as a guide in drawing the curved line JHC. The guide-lines being drawn, determine the apparent distance between the points in the rim corresponding to E and F, as compared with the distance between the points A and B, and place points, as E and F, to mark this distance, making the distance from F to AB a little less than the distance of E from this line; and then through these points draw the outline of the rim. Guided by the lines AD and BC, draw AJ, and the corresponding line on the opposite side of the tub. In drawing these lines make them straight, and very light; for parts of these lines are to be erased when the hoops are drawn. Next place a point, as H, vertically under E, making the distance from E to H a little greater than the measure of AD; and then, guided by DC, draw the curved line at the bottom of the tub. Having obtained the general outline, complete the drawing by taking up the details in the following order, — first the rim, then the hoops, next the stick, and finally the lines marking the staves.

LESSON XII.

The example given in this lesson will afford the pupil further practice in drawing circular forms seen obliquely; and, if thoughtfully considered, it will be of assistance to him in his study of light, shade, and shadow. His attention should be especially directed to the value of the shadow cast by the hoop which leans against the barrel.

It will be observed that the hoop does not appear to touch the ground or the barrel, except at the points I and L. It looks as though you could put your hand between the barrel and the hoop. This relief is due principally to this shadow.

Notice, also, how much the form of the shadow assists in indicating the form of the surface on which it falls. The shadow on the ground clearly indicates that it is a plain, smooth surface; that on the barrel as clearly shows it to be cylindrical in form; and, when it falls on the hoops, it makes their projection beyond the surface of the barrel perfectly apparent. Before shading this example, call the attention of the pupil to the law relating to light and shade on cylindrical forms. In adding the lines used to give character to the surface, it is neither necessary nor desirable that the pupil should put them in, line for line, and dot for dot, as found in the example. Let him notice the idea conveyed, and carefully study the means used to express it; then let him rely upon himself, referring to the example occasionally for suggestions. The merit of the pupil's work, so far as regards the means used in the expression of ideas, is not to be judged by its likeness to the copy, but by the impression which it makes upon the mind. If his drawing conveys the same ideas expressed by the copy, and with equal force, it is just as good as the copy, no matter if every line in it differs from those in the example.

In drawing this example, make it of full size. It is not intended that the figure accompanying the example should be drawn.

How ought we to proceed in drawing from a subject like the one represented in this example?

First draw a line, as *ad*, Fig., to represent the height of the barrel. Then consider the distance across the chimbs, that is, the distance from A to B compared with the height of the barrel; and draw a line, as *ab*, to represent this dis tance. Next draw a line, as *bc*, equal to *ad*, and then draw the guide-line *dc*. Next consider the apparent height of the point H above the point J, as compared with the distance from A to B, and place points, as *h* and *j*, making the distance from *j* to *ab* a little greater than the distance from *h* to *ab;* then, through the four points *a*, *h*, *b*, and *j*, draw a curved line, as shown in the figure, to represent the outline of the chimbs. Next consider how much the line AD in the barrel varies from a straight line, and draw the curved line *ad*. In like manner, consider the line BC in the barrel, and draw the curved line *bc*. Then, bearing in mind that the part JE of the barrel is nearer than the parts AD and BC, place a point, as *e*, a little farther from *dc* than *j* is from *ab*. Next place a point, as *f*, making its distance from *dc* a little less than the distance of *e* from *dc*; and then, guided by *dc*, draw a curved line through the points *d*, *f*, *c*, and *e*, as shown in the figure to represent the bottom of the barrel. In drawing the outline of a circle, where only a part of the figure is seen, as in this case, it is in general advisable to draw its entire outline; for, by adopting this course, one is more certain of getting a correct drawing of the part seen than he is if he undertakes to draw this alone. When a correct drawing of the circle has been obtained, the outline of the part not visible may be erased.

Having secured the general outline of the barrel, consider where the hoops are placed, and, guided by the curved lines already drawn, sketch them in very lightly. Next consider the exact point on the barrel where the hoop which leans against it comes in contact with it, and place a point, as *i*, to mark the spot. Next observe what point in the outline of the bottom of the barrel the point L of the hoop seems to be on a level with; place a point, as *h*, to mark the point; and from *h* draw a horizontal line, as *hl*, of indefinite length. Next consider the distance of L from H, and place a point, as *l*, to mark this distance; and then draw *il*, as a guide in drawing the outline of the hoop. Next draw the hoop. Then carefully draw in the detail of all the parts, add the shade, and finally the lines giving character to the parts.

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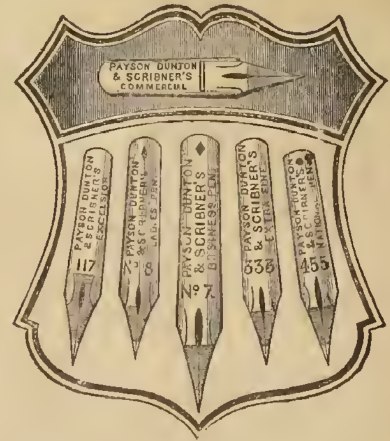
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